



## Software Defined Optics and Networking for Large Scale Data Centers

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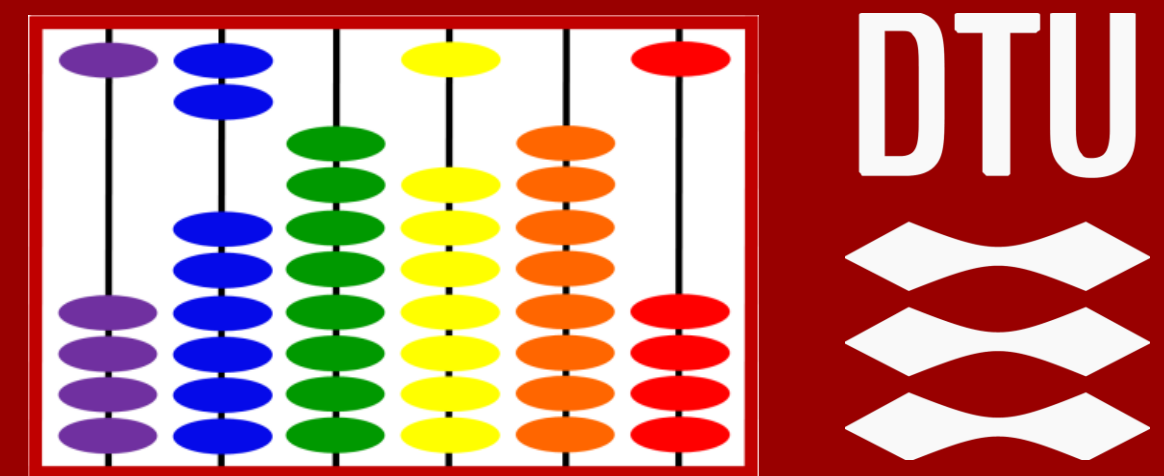
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# Software Defined Optics and Networking for Large Scale Data Centers

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## Motivation

Big data imposes correlations of large amounts of information between numerous systems and databases. This leads to large dynamically changing flows and traffic patterns between clusters and server racks that result in a decrease of the quality of transmission and degraded application performance.

Highly interconnected topologies combined with flexible, on demand network configuration can become a solution to the ever-increasing dynamic traffic.

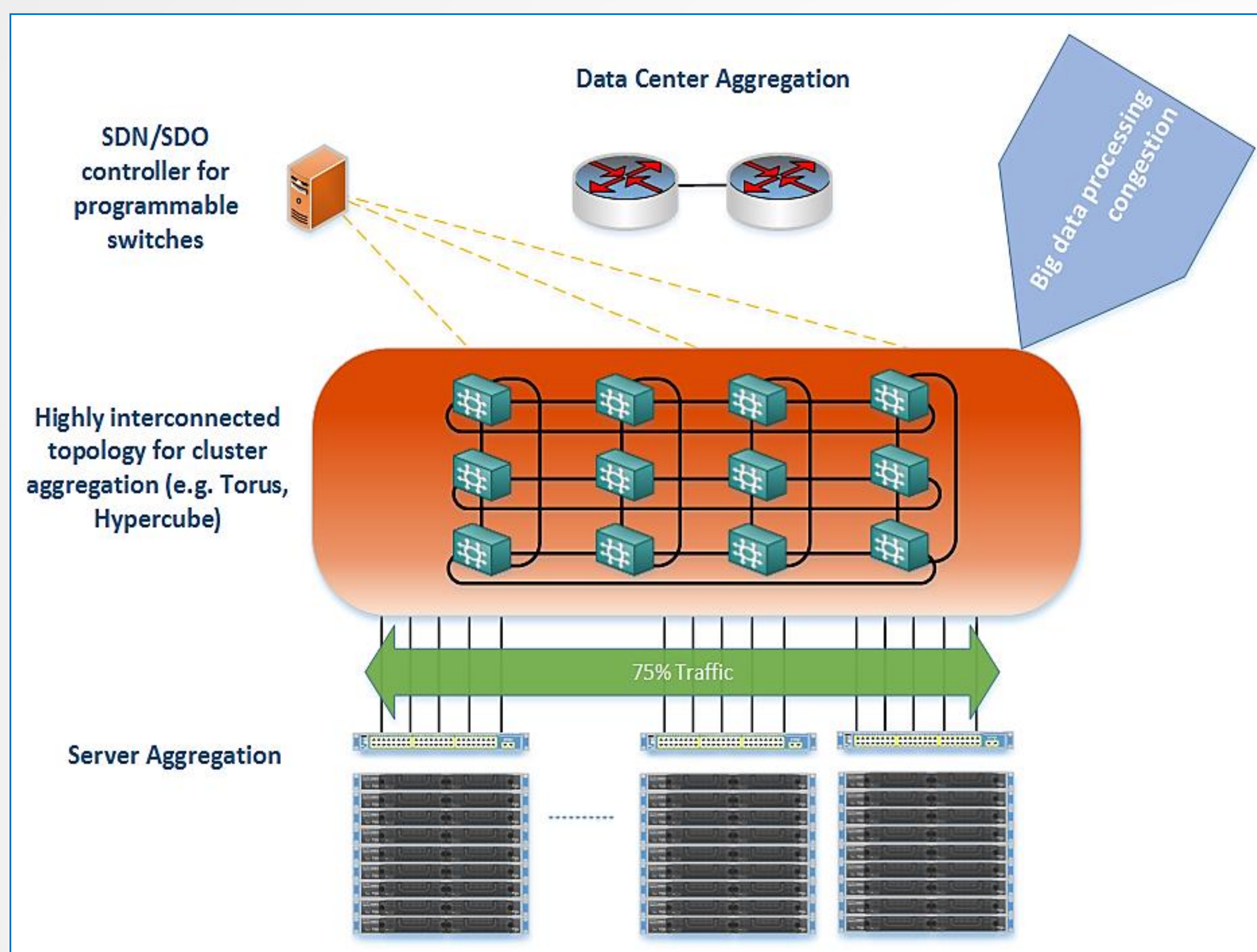


Figure 1 – Proposed Data Center Architecture

## SDN

- SDN is a mechanism not a solution
- Physical separation of the control plane from the forwarding plane
- Controlling multiple forwarding devices with a single control element
- Global view for traffic/flow configuration
- Provides: better control, better guaranties NOT necessarily simplicity
- Open controller API for applications that granularly manage networks down to the individual flows

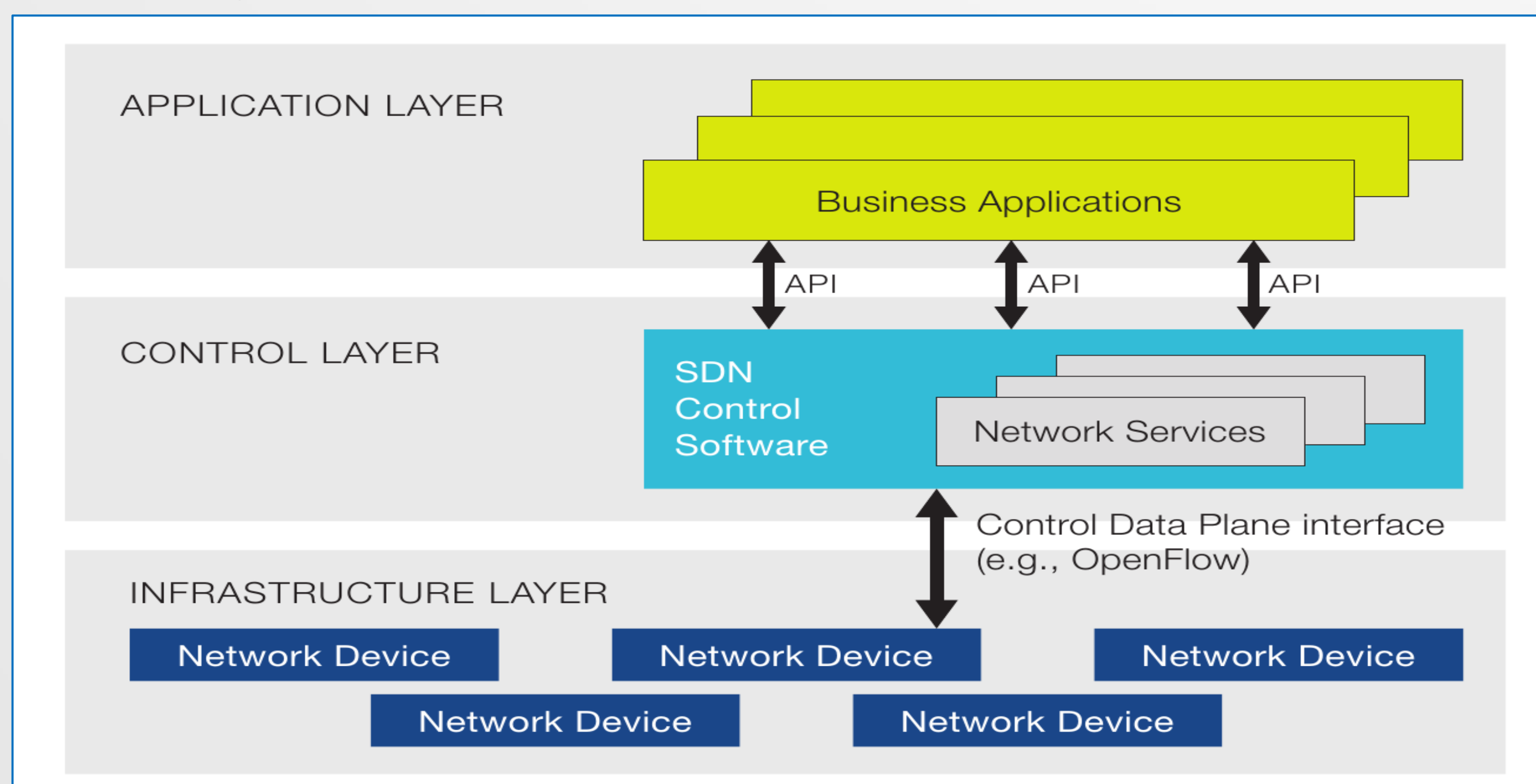


Figure 2 – SDN Architecture

## Interconnection Topologies

Topologies like *torus* (Fig. 1) or *hypercube* (Fig. 3) for cluster aggregation greatly reduce the risks of congestion and bottlenecks by providing multiple redundant paths.

Downside: not cost effective for current technologies.

Low cost bear metal switches + controller = performant and cost effective solution

## Testing Environment

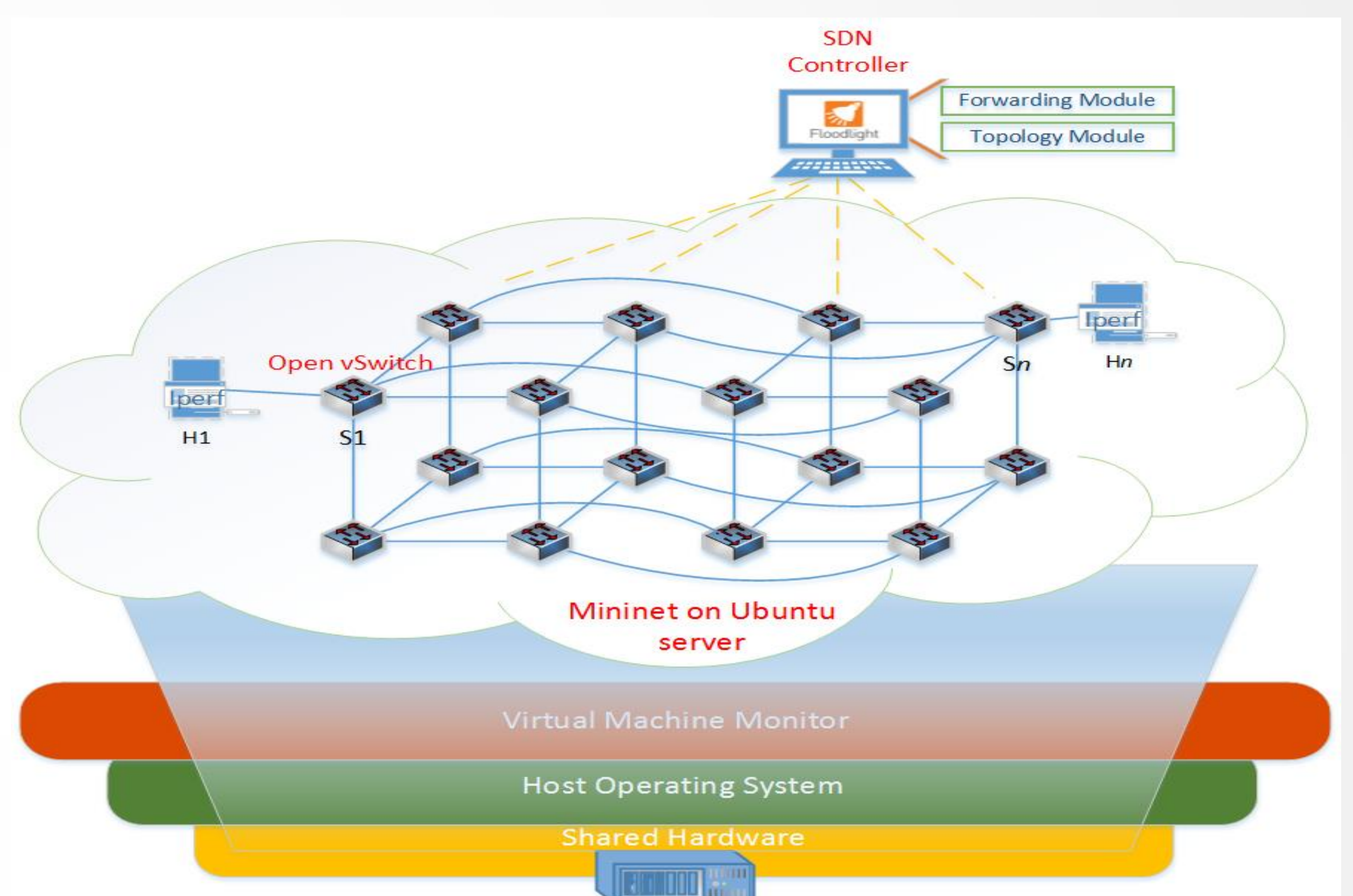


Figure 3 – The virtual topology in Mininet uses vEth pairs to connect Open vSwitches and hosts (shell processes) that generate traffic and gather performance statistics. The Floodlight controller, running on a different server, computes flow paths based on a forwarding and a topology module.

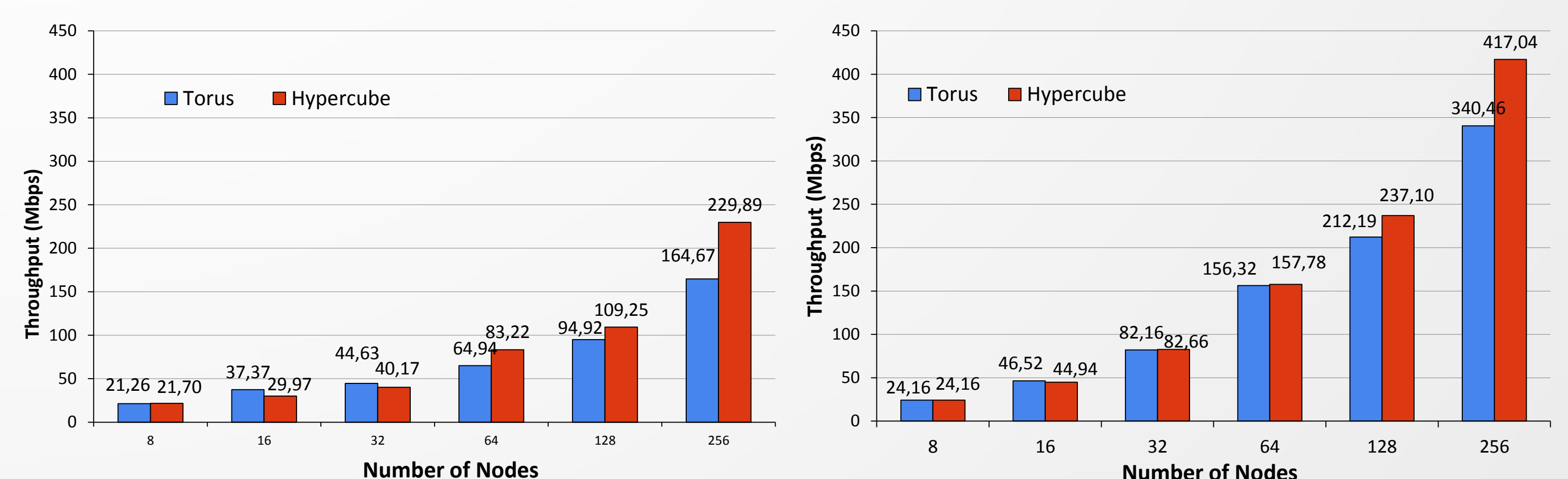


Figure 4 – Tested SDN set-up shows significantly higher performance levels. An increase of 44% in throughput is measured, compared to current switching technologies.

## SDO Objectives

- Transmission over a flexible WDM grid
- Universal Tbit/second transponder architecture
- Optical layer resource allocation
- Reduced power consumption
- Increased spectral efficiency